

# Breastfeeding cessation in the era of Elimination of Mother to Child Transmission of HIV in Uganda: a retrospective cohort study

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## Research

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# Abstract

**Background:** Among human immunodeficiency (HIV) infected mothers, the World Health Organization (WHO) recommends cessation of breastfeeding at one year to prevent HIV transmission but data are limited. We examined the frequency and factors associated with cessation of breastfeeding at one year among HIV infected postpartum mothers at Ndejje Health Center IV, a large peri-urban health facility in Uganda.

**Methods:** This retrospective cohort study involved all HIV infected postpartum mothers enrolled in HIV care for at least 12 months between June 2014 and June 2018. We abstracted data from registers, held focused group discussions with HIV infected postpartum mothers, and key informant interviews with healthcare providers. Cessation of breastfeeding was defined as the proportion of HIV infected postpartum mothers who had stopped breastfeeding at one year. We summarized quantitative data descriptively, tested differences in outcome with the Chi-square and t-tests, and established independently associated factors using the modified Poisson regression analysis at 5% statistical significance level. We thematically analyzed qualitative data to enrich and triangulate the quantitative results.

**Results:** Of 235 HIV infected postpartum mothers, 150 (63.8%) ceased breastfeeding at one year and this was independently associated with the HIV exposed infant (HEI) being female than male (Adjusted risk ratio (aRR): 1.25, 95% confidence interval (CI), 1.04, 1.50), the mother being multiparous than primiparous (aRR, 1.26; 95% CI, 1.04-1.53), and breastfeeding initiation on same-day as birth (aRR, 0.06; 95% CI, 0.01-0.41). Qualitative results showed that partner reminders about breastfeeding adequacy of BF knowledge and maternal literacy facilitated continued breastfeeding until one year. Inadequate breastfeeding knowledge, casual and formal work demands, in addition to increased breastfeeding demand among boys led to cessation of breastfeeding before one year.

**Conclusion.** Cessation of breastfeeding at one year among HIV infected postpartum mothers was suboptimal and this might increase risk of mother to child transmissions of HIV. Cessation of breastfeeding was more likely among female HEIs and multiparous mothers, and less likely when breastfeeding is initiated on same-day as birth. Interventions to enhance cessation of breastfeeding at one year should target groups of women with lower rates.

## Background

In sub-Saharan African region (SSA), an estimated 60% of infants born to human immunodeficiency virus (HIV) infected mothers acquire HIV during pregnancy, delivery, or breastfeeding.(1) In Uganda, the rate of mother to child transmission of HIV (MTCT) falls within the range of 5-30% (1), and the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimates that 1.4 million people were living with HIV, with 740,000 being women aged  $\geq 15$  years in 2018.(2) Following the scale up of Elimination of mother to child transmission (EMTCT) Option B Plus policy, at least 90% of pregnant women living with HIV are now on lifelong anti-retroviral therapy (ART).(3) The increasing number of women on EMTCT program is

attributed to accreditation of many lower level health facilities to provide ART to both HIV infected pregnant and breastfeeding women.(4) Although EMTCT has led to an estimated 86% reduction in HIV infection among children between 2010 and 2016, 14% of HIV exposed infants (HEIs) get infected with HIV during breastfeeding, which is still high.(5)

Breastfeeding among HIV infected mothers is recommended because it protects infants from morbidity and mortality. A scoping review of breastfeeding among pregnant women living with HIV that included 35 studies in sub Saharan Africa found that healthcare workers' personal biases, inadequate counselling skills, mother's limited EMTCT knowledge, a culture of mixed feeding norms, maternal lack of decision-making power, limited follow-up of mothers after delivery, and HIV related stigma associated with replacement feeding are some of the factors that hinder cessation of breastfeeding at one year among women living with HIV.(6)

To address these critical barriers, EMTCT programs should support HIV infected mothers to cease breastfeeding at one year by providing adequate breastfeeding information and ensure maximum retention of mother baby pairs throughout the follow up period over (6). Cessation of breastfeeding at one year among HIV infected postpartum mothers is recommended per the WHO EMTCT guidelines (7). Failure to follow the recommended breastfeeding options among HIV infected postpartum mothers' increases the chance of HIV acquisition by infants through breastfeeding.

Ndejje Health Center IV is one of the several health facilities accredited in Wakiso district to provide EMTCT Option B Plus, a strategy for elimination of MTCT of HIV. However, anecdotal observations at the EMTCT clinic indicate that some HIV exposed infants (HEIs) acquire HIV infection at one year due to prolonged breastfeeding. Second, data are limited on the magnitude and factors associated with cessation of breastfeeding at one year among HIV infected postpartum mothers. Our study therefore examined the frequency of cessation of breastfeeding at one year and the associated factors among HIV infected postpartum mothers at a large peri-urban health facility in Uganda. The findings of this study will inform the implementation of breastfeeding practices as per the recommendations of EMTCT guideline.

## Methods

### Study design and setting

We used qualitative and quantitative methods of collection and both were implemented concurrently. For the quantitative component, we designed a retrospective cohort study using available data within the EMTCT program in which exposure to breastfeeding had occurred at some time in the past. For the qualitative component, we held interviews with healthcare providers as key informants and focus group discussions with HIV infected postpartum mothers to enrich and triangulate the quantitative results. The study design was largely quantitative and data convergence was established at results interpretation. The cohort consisted of all HIV infected postpartum mothers enrolled on EMTCT program between June 2014 and June 2018 at Ndejje Health Center (HC) IV, a large peri-urban health facility in Makindye Division, Wakiso district, Uganda.

Ndejje HC IV is a county level health facility according to Uganda's health system accreditation system and provides curative, preventive, rehabilitative, and promotive health services to an estimated 100,000 population (8). Ndejje HC IV serves a greater proportion of HIV infected mothers largely from the eight divisions of Busabala, Masajja, Bunamwaya, Kigo, Mutungo, Ndejje, Sseguku, and Mutundwe. The health facility serves approximately 133,068 patients per year which is a high patient load compared to its threshold. Currently, the health facility has a total of 61 staffs, nine of which are dedicated to the MCH clinic.

The health facility implements the Uganda national and World Health Organization's Option B Plus policy (9), which we have fully described elsewhere.(10, 11) Under this policy, all HIV infected pregnant mothers are started on Anti-retroviral Therapy (ART) for life regardless of their immunological and clinical status and HEIs receive Nevirapine syrup as prophylaxis from birth until six weeks adjusted according to weight and age bands.

At six weeks, Nevirapine prophylactic syrup is stopped and Cotrimoxazole prophylaxis is introduced and a dry blood spot obtained for HIV test using Deoxyribonucleic Acid-Polymerase Chain Reaction (DNA-PCR). At one year, breastfeeding ceases and a second dry blood spot is obtained at exactly six weeks after cessation of breastfeeding for DNA-PCR test. A final diagnosis of HIV is performed at 18 months using a rapid antibody test. However, when HEIs seroconvert (test positive for HIV) at any of the testing time points, ART is started and Cotrimoxazole prophylaxis continued for life. HEIs receive exclusive breastfeeding for the first six months of life followed by complementary feeding.

To minimize loss of mother-baby pairs and improve retention, Uganda introduced a concept of Mother-Baby Care Point (MBCP) which is a service delivery model in the maternal and child health (MCH) clinic. The MBCP delivery model ensures HIV infected mothers and HEIs are paired and cared for together until the HEI reaches 18 months postpartum, a time when the final HIV infection status is determined (12). Entry into the MBCP starts immediately after delivery because the mother and HEI have to receive HIV care as a single pair. The MBCP at Ndejje HC IV has four healthcare providers (two midwives and two nursing officers), with one of them as the team leader. It operates five days a week, Monday to Friday, from 8.00 am to 5.00 pm, in accordance to the Uganda labor laws. Mothers routinely receive health education and counseling on various topics like PMTCT, nutrition, newborn care practices, maternal and newborn hygiene and breastfeeding among others.

Data are collected through paper-based system using HIV/ART care cards and EID and EMTCT registers, and later entered into an electronic database, the Open Medical Records System (Open-MRS). To ensure data quality, weekly data reviews are conducted alongside continuous quality improvement initiatives to address gaps in quality of HIV care. Notable quality improvement initiatives at the MBCP have targeted improved recording and reporting of data in the EMTCT and EID registers, uptake of HIV testing at six weeks, and maternal nutritional assessment using Mid-upper arm circumference (MUAC) among others.

## **Study population and sample size**

The study population consisted of all HIV infected postpartum mothers enrolled to EMTCT program for at least one year, and all of them were still receiving HIV care at the time of data abstraction. We excluded HIV infected postpartum mothers with infants below one year of age because cessation of breastfeeding is at one year. So it would be erroneous to measure cessation of breastfeeding in such mother-baby pairs. Mother-baby pairs transferred to other health facilities were equally excluded because it was not possible to obtain data on cessation of breastfeeding. We further excluded records for mother-baby pairs where the HEI had died or seroconverted and those gross missing data. We did not calculate a sample size but used census sampling as a retrospective cohort study that consisted of records review was conducted. Four focus group discussions (FGDS) of eight to 12 HIV infected postpartum mothers each were randomly selected among those attending the EMTCT clinic. Four healthcare providers directly involved in providing care at the MBCP were purposively selected as key informants and interviewed.

## **Study variables**

Our outcome variable was cessation of breastfeeding at one year, measured on a binary scale (yes or no), defined as the number of HIV infected postpartum mothers documented in the early infant diagnosis of HIV (EID) register who had stopped breastfeeding at one year. The independent variables included: maternal variables such as age in years but later dichotomized as below 25 or 25 years and beyond, antenatal care (ANC) attendance at last pregnancy measured as yes and no, number of ANC visits at last pregnancy, ART regimen categorized as Tenofovir (TDF) or Zidovudine (AZT) containing regimens, parity measured as nulliparous, secundiparous, and multiparous, and place of delivery measured as health facility or home. The infant variables included age in months, sex (male or female), time of initiation of cotrimoxazole prophylaxis (before six weeks or six weeks and beyond), and same-day initiation of breastfeeding (yes or no).

The qualitative variables explored included modes of mother to child transmission of HIV and likely preventive measures, importance of breastfeeding, when to stop breastfeeding in an HEI, and reasons for stopping to breastfeed before or after one year of age.

## **Data collection**

### ***Qualitative data***

To enrich and triangulate the quantitative results, we conducted qualitative interviews with HIV infected postpartum mothers and healthcare providers. In particular, we held four focus group discussions (FGDs), each consisting of eight to 12 HIV infected postpartum mothers selected randomly from amongst those attending the EMTCT clinic. The group consisted of mothers who had ceased breastfeeding and those due for cessation of breastfeeding at one year. The FGDs were held within the premises of the health facility in the local language, "*Luganda*", by two research assistants (JGP and MN, both female MPH postgraduate students trained in qualitative research methods). One research assistant (JGP) moderated all the FGDs while the other (MN) audio-recorded the responses and probed where necessary. Each FGD lasted for about 40-60 minutes on average.

The moderator encouraged all the group members to ask questions and to provide comments as much as possible, irrespective of the correctness. Group dominance by some members of the FGD was minimized by directing some probing questions and comments to other members of that group who seemed to engage less in the discussions. For key informant interviews (KII), four healthcare providers namely, two Midwives and two nursing officers directly engaged in the provision of EMTCT services at the MBCP were purposively selected and interviewed to elicit their expert opinions on practices of cessation of breastfeeding among HIV infected mothers. The KII lasted for 30-45 minutes, also conducted within the health facility premises in English language, but in a quiet and convenient room. Both FGDs and KIIs were held until saturation was reached.(13)

### ***Quantitative data***

We reviewed the PMTCT and EID registers for all eligible participants and abstracted data using a standardized checklist between April and May 2019. Whenever data were missing in the EID and EMTCT registers, the HIV care cards and the electronic database (Open MRS) were used to retrieve such data where possible.

### **Data processing and analysis**

#### ***Qualitative data***

We audio-recorded all interviews and transcribed them verbatim. To ensure accuracy in transcription, we correlated the audio-recordings with the transcripts by replaying it while reading through the transcripts. We exported the transcripts to Nvivo, a qualitative data analysis software, for thematic analysis. Three reviewers JGP (MPH postgraduate student), JI (Public health specialist and mixed-methods research fellow), and SO (Public health specialist and research supervisor) read the transcripts thoroughly and independently, and identified emergent categories and themes through coding using inductive data analysis approach. Independent coding was used to prevent selective perception and interpretive biases in the coding process. JGP, JI and SO discussed the categories and themes in a group, and then developed explicit summaries describing each category and theme. Discrepancies in the emergent categories and themes were resolved by consensus and a final codebook was thereafter developed. The verbatim quotations were then used to enrich and triangulate the quantitative results.

#### ***Quantitative data***

We single-entered quantitative data using Epi-Data version 3.1 (14) concurrent with quality control measures namely skip patterns, alerts, range and legal values, and then exported the data to Stata version 15 for analysis.(15) We analyzed numeric data using descriptive statistics of means and standard deviations, and categorical data using frequencies and percentages. The outcome variable was computed as the proportion of HIV infected postpartum mothers who had stopped breastfeeding at one year.

We tested differences in proportions of cessation of breastfeeding at one year with categorical variables using the Chi-squared test for large cell counts (five and more counts) and the Fisher's exact test for smaller cell counts (less than five counts). To test mean differences in cessation of breastfeeding at one year with numerical variables such as age, we used the student's t-test. We performed sensitivity analysis to examine the effect of missing data on cessation of breastfeeding feeding for infant sex and maternal ART regimen at bivariate analysis.

We considered variables with probability values (p values) less than five percent at bivariate analysis as statistically significant for univariable and multivariable analyses. We also considered variables such as maternal age, parity, and same-day initiation of breastfeeding as birth as biological plausible factors for cessation of breastfeeding at one year at univariable and multivariable analyses. Our data showed that the outcome variable was frequent (more than 10%). Accordingly, the odds ratio (OR) was not an appropriate measure of association because of overestimation.<sup>(16, 17)</sup> We hence used risk ratios (RR) for both unadjusted and adjusted analysis computed using the modified Poisson regression analysis with robust error variance to control for mild violations of the assumptions of Poisson regression analysis. We reported each RR with subsequent 95% confidence intervals (CI). We noted that five (2.1%) observations were missing for the variable infant sex but did not impute them at multivariate analysis because they were fewer than 10%.

## **Human subject issues**

Clarke International University Research Ethics Committee, CIU-REC (reference #CIU-REC/0136), approved this study. We received administrative approval from the Health Department of Wakiso district (reference # CR: MSMC 220/1). Key informants and focus group participants provided a written informed consent after explaining the purpose and benefits of the research as well as the risks involved. Participation in the study was voluntary and participants were free to withdraw at any stage if they so wished. All participant data were handled with confidentiality and privacy, and individual identifiers were anonymized.

# **Results**

## **Study profile**

Figure 1 presents a summary of the study profile. Our data shows that 610 mother-baby pairs were enrolled to the EMTCT program between June 2014 and June 2018. Of those enrolled, 77 were excluded because they had transferred to other health facilities. Of the remaining 533 mother-baby pairs, 183 were excluded for the following reasons: 24 HEIs had died, 142 mother-baby pairs were lost to follow-up, and 17 HEIs had seroconverted and were started on ART. Of 350 mother-baby pairs, another 115 were excluded: 28 HEIs were below one year age and 87 had gross missing data. The final number of records analysed was for 235 mother-baby pairs.

## **Socio-demographic characteristics of HIV infected mothers and HEIs**

Table 1 shows the socio-demographic characteristics of mother-baby pairs. Of the 235 HIV infected mothers in the cohort, 138 (58.7%) were aged 16 to 25 years, 69 (29.4%) were multiparous, 119 (50.6) had not attended ANC at recent pregnancy, 220 (96.7%) had delivered in a health facility, and 116 (49.4%) of the HEIs were of female sex. The mean age of all the participants was 25.2±4.8 years and ranged from 16 to 39 years. The median age was 24 years (IQR: 22-28 years).

**Table 1: Socio-demographic characteristics of HIV infected mothers and HEIs**

| Characteristics                 | Level                   | All (n= 235)<br>n(%) |
|---------------------------------|-------------------------|----------------------|
| <b>Maternal age category</b>    | 16-25                   | 138 (58.7)           |
|                                 | 25 and more             | 97 (41.3)            |
| Age (continuous)                | Mean Standard deviation | 25.2±4.8             |
| <b>Maternal parity</b>          | 1                       | 95 (40.4)            |
|                                 | 2                       | 71 (30.2)            |
|                                 | ≥3                      | 69 (29.4)            |
| <b>Ever attended ANC visits</b> | Yes                     | 96 (40.8)            |
|                                 | No                      | 119 (50.6)           |
|                                 | Missing data            | 20 (8.5)             |
| <b>Place of delivery</b>        | Home                    | 7 (3.1)              |
|                                 | Health facility         | 220 (96.9)           |
| <b>Infant sex</b>               | Male                    | 114 (48.5)           |
|                                 | Female                  | 116 (49.4)           |
|                                 | Missing data            | 5 (2.1)              |

### **Bivariate analysis of cessation of breastfeeding at one year by maternal and HEI factors**

Table 2 summarized differences in cessation of breastfeeding at one year with respect to maternal and infant factors. Overall, our data showed that 150 (63.8%) HIV infected postpartum mothers' had ceased breastfeeding at one year.

**Table 2: Bivariate analysis of cessation of breastfeeding at one year among HEIs by maternal and infant factors.**



| Characteristics                                      | Ceased breastfeeding at one year |              |              | p value |
|--|----------------------------------|--------------|--------------|---------|
|  | No (n=85)                        | Yes (n= 150) | All (n=235)  |         |
| <b>Maternal age category</b>                         | <b>n (%)</b>                     | <b>n (%)</b> | <b>n (%)</b> | 0.051   |
| 16-25  | 57 (67.1)                        | 81 (54.0)    | 138 (58.7)   |         |
| 25 and more  | 28 (32.9)                        | 69 (46.0)    | 97 (41.3)    |         |
| Mean ± Standard deviation                            | 24.3±0.52                        | 25.7±0.39    | 25.2±4.8     | 0.027   |
| <b>Maternal parity</b>                               |                                  |              |              | 0.116   |
| 1  | 38 (44.7)                        | 57 (38.0)    | 95 (40.4)    |         |
| 2  | 29 (34.1)                        | 42 (28.0)    | 71 (30.2)    |         |
| ≥3   | 18 (21.1)                        | 51 (34.0)    | 69 (29.4)    |         |
| <b>Breastfeeding initiation on same-day as birth</b> |                                  |              |              | <0.01   |
| No   | 60 (70.6)                        | 148 (98.7)   | 208 (88.5)   |         |
| Yes  | 25 (29.4)                        | 2 (1.3)      | 27 (11.5)    |         |
| <b>Ever attended ANC visits</b>                      |                                  |              |              | 0.020   |
| Yes  | 34 (40.0)                        | 62 (41.3)    | 96 (40.8)    |         |
| No   | 38 (44.7)                        | 81 (54.0)    | 119 (50.6)   |         |
| Missing data   | 13 (15.3)                        | 7 (4.7)      | 20 (8.5)     |         |
| <b>Place of delivery</b>                             |                                  |              |              | 0.690   |
| Home   | 2 (2.5)                          | 5 (3.4)      | 7 (3.1)      |         |
| Health facility                                      | 79 (97.5)                        | 141 (96.6)   | 220 (96.9)   |         |
| <b>Time of Cotrimoxazole prophylaxis initiation</b>  |                                  |              |              | 0.040   |
| <6 weeks   | 28 (32.9)                        | 79 (52.7)    | 107 (45.5)   |         |
| ≥6 weeks   | 57 (67.1)                        | 71 (47.3)    | 128 (54.5)   |         |
| <b>Infant sex</b>                                    |                                  |              |              | 0.002   |
| Male   | 53 (62.3)                        | 61 (40.7)    | 114 (48.5)   |         |
| Female   | 32 (37.6)                        | 84 (56.0)    | 116 (49.4)   |         |
| Missing data   | 0 (0.0)                          | 5 (3.3)      | 5 (2.1)      |         |
| <b>Mothers ART regimen</b>                           |                                  |              |              | 0.08    |
| AZT based regimen                                    | 7 (8.2)                          | 3 (2.0)      | 10 (4.3)     |         |
| TDF based regimen                                    | 69 (81.2)                        | 136 (90.7)   | 205 (87.2)   |         |
| Other regimens                                       | 6 (7.1)                          | 6 (4.0)      | 12 (5.1)     |         |
| Missing data   | 3 (3.5)                          | 5 (3.3)      | 8 (3.4)      |         |

Most mothers that had ceased breastfeeding were in the aged category of 16 to 25 years (54.0%) compared to those ≥25 years (46.0%), had not initiated breastfeeding on same-day as birth (98.7%) compared to those who had initiated breastfeeding on same-day as birth (1.3%), had not attended ANC at the recent pregnancy (54.0%) compared to those who had attended ANC at recent pregnancy (41.3%), and had delivered in a health facility (96.6%) than at home (3.4%). The proportion of cessation of breastfeeding was slightly higher among HEIs with Cotrimoxazole prophylaxis initiation before six weeks of age (52.7%) compared to those with initiations at six weeks or thereafter (47.3%) and in female HEIs (56.0%) than male HEIs (40.7%).

We observed statistically significant differences in cessation of breastfeeding with respect to breastfeeding initiation on same-day as birth ( $p < 0.01$ ), ever attending ANC visits at recent pregnancy ( $p = 0.02$ ), time of initiation of Cotrimoxazole prophylaxis ( $p = 0.04$ ) and infant sex ( $p = 0.002$ ). Maternal age category demonstrated borderline statistical significance ( $p = 0.051$ ). Mothers who had ceased breastfeeding at one year were on average older than those who had ceased breastfeeding:  $25.7 \pm 0.39$  versus  $24.3 \pm 0.52$ ,  $p = 0.027$ ). There was no statistically significant difference in cessation of breastfeeding with regard to parity, place of delivery, and ART regimen (all  $p > 0.05$ ). Sensitivity analysis showed similar results of statistical significance for the variables infant sex and maternal ART regimen with cessation of breastfeeding in the presence and absence of missing data. This suggests that the results are robust to missing data.

### Factors associated with cessation of breastfeeding at one year

In unadjusted analysis (Table 3), our data showed that cessation of breastfeeding at one year was more likely when the HEI was female than male (Unadjusted RR (URR), 1.35, 95% CI, 1.10-1.66), and when the HIV infected postpartum mothers was  $\geq 25$  years of age compared to less than 24 years of age (URR, 1.21, 95% CI, 1.00-1.46).

**Table 3: Unadjusted and adjusted analysis of factors associated with HIV cessation of breastfeeding at one year among HEIs.**

| Characteristics                               | Level          | Modified Poisson regression analysis |             |        |             |
|---|----------------|--------------------------------------|-------------|--------|-------------|
|   |                | uRR                                  | 95% CI      | aRR    | 95% CI      |
| Infant sex <sup>§</sup>                       | Male           | Ref                                  |             | Ref    |             |
|   | Female         | 1.35**                               | (1.10,1.66) | 1.25*  | (1.04,1.50) |
| Maternal age group                            | $\leq 24$      | Ref                                  |             | Ref    |             |
|   | $\geq 25$      | 1.21*                                | (1.00,1.46) | 1.08   | (0.91,1.28) |
| Maternal parity                               | 1              | Ref                                  |             | Ref    |             |
|   | 2              | 0.99                                 | (0.76,1.27) | 1.02   | (0.81,1.30) |
|   | $\geq 3$       | 1.23                                 | (0.99,1.53) | 1.26*  | (1.04,1.53) |
| Ever attended ANC visits                      | No             | Ref                                  |             |        |             |
|   | Yes            | 1.05                                 | (0.87,1.28) |        |             |
| Breastfeeding initiation on same day as birth | No             | Ref                                  |             | Ref    |             |
|   | Yes            | 0.10***                              | (0.03,0.40) | 0.06** | (0.01,0.41) |
| Time of Cotrimoxazole prophylaxis initiation  | <6 weeks       | Ref                                  |             | Ref    |             |
|   | $\geq 6$ weeks | 0.87**                               | (0.79,0.95) | 0.93   | (0.86,1.02) |

**Note:** 1) 95% confidence intervals for risk ratios (RR) are in brackets; 2) \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$  at 5% level of significance; 3) Adjusted analysis included all statistically significant variable at unadjusted analysis; 4) Ref: Reference category; 5) uRR Unadjusted RR; 6) aRR: Adjusted RR. <sup>§</sup>The variable infant sex has five missing observations which were not imputed at adjusted analysis.

Conversely, cessation of breastfeeding was less likely when Cotrimoxazole prophylaxis was initiated at or after six weeks of birth relative to before six weeks of birth (URR 0.87; 95% CI, 0.79-0.95) and when the

HIV infected postpartum mother had initiated breastfeeding on same-day as birth (URR, 0.10; 95% CI, 0.03-0.40). ANC attendance at recent pregnancy was not associated with cessation of breastfeeding at one year (URR, 1.05; 95% CI, 0.87-1.28).

After adjusting for all statistically significant and clinically relevant factors, our results showed that cessation of breastfeeding was more likely in female than male HEIs (Adjusted RR (aRR), 1.25; 95% CI, 1.04, 1.50). Cessation of breastfeeding was more likely when the HIV infected postpartum mothers was multiparous than primiparous (aRR, 1.26; 95% CI, 1.04-1.53). We also found that HIV infected postpartum mothers who had initiated breastfeeding on same-day as birth were less likely to cease breastfeeding at one year compared to those who had delayed breastfeeding initiation on same-day as birth (aRR, 0.06, 95% CI, 0.01-0.41).

Several reasons for continuity and cessation of breastfeeding at one year emerged from the qualitative data (Table 4). Two themes namely partner reminders about breastfeeding, and adequacy of breastfeeding knowledge and maternal literacy explained the reasons for continuity. Three themes namely insufficiency of breastfeeding knowledge, casual and formal work demands, and increased breastfeeding demand among boys than girls highlighted the reasons for cessation.

**Table 4: Reasons for breastfeeding continuity and cessation among HIV infected postpartum mothers.**

| Participant quotes   | Categories   | Themes  |
|--|--|---|
| <i>If you are not married you can breast feed your child to whatever time you want or stop whenever you want. But for the married women, your husband will ask you why the baby is not breast feeding, your husband can also remind you of the recommended time of stopping to breast feed” (FGD 3 with HIV infected mothers).</i>           | Married women breastfeed as recommended.   | Partner reminders about breastfeeding                     |
| <i>A married woman is different from single one, a single mother has no time to breast feed due to the responsibility of looking for basic needs, but married women get the support from the husband” ((FGD 2 with HIV infected mothers).</i>  |  |   |
| <i>I cannot afford to buy those manufactured milk for my baby because I have to buy food, pay fees and treat the sisters and brothers, so I preferred to breast feed until the time Musawo (meaning nurse) told me to stop breast feeding. I was told to stop at 1 year sharp” (FGD 4 with HIV infected mothers).</i>                        | Adherence to health care provider breastfeeding advice                           | Adequacy of breastfeeding knowledge and maternal literacy |
| <i>When mother is educated, she is able to understand what I say, she can even go ahead and read and understand more, she can see the pictures and charts we have here and is able to read compared to those who never went to school, we have to repeat several times before she can understand (KII 1 with healthcare provider).</i>       | Better understanding of breastfeeding advice by educated than illiterate mothers |   |
| <i>Of course those who are more educated do not disturb us, they follow whatever we say and even and want their babies healthy” (KII 2 with healthcare provider).</i>  |  |   |
| <i>When mother is far, she comes late, some times when I have finished health education and she ends up missing. Somehow she may fail to follow the guideline and even breast feed more than one year or believe that not breast feeding when the teeth are out is the better (KII 3 with healthcare provider).</i>                          | Missed information on breastfeeding guideline                                    | Insufficiency of breastfeeding knowledge                  |
| <i>The girls who have one or two children do not want to breast feed, they say that they do not want their breasts to fall (KII 1 with healthcare provider).</i>   | Unwillingness to breastfeed among primiparous mothers                            |   |
| <i>I am just 23 years with my child, I had to leave him at home with his grandmother and go to work to support him so he does not get consistence breast milk and ended up leaving to breast feed completely by himself. But he is okay after all he started to breastfeed early (FGD 3 with HIV infected mothers).</i>                      | Difficulty in balancing breastfeeding with work demands                          | Casual and formal work demands                            |
| <i>How can I start to breastfeed on day 1 until 1 year? I have seen some other young girls leaving their children with the grand mothers and go work in other houses as house workers, they end up leaving the child from breast feeding at even 6months once they start eating, this is very common (FGD 3 with HIV infected mothers ).</i> |  |   |
| <i>Personally, I stopped breast feeding boys at 9 months because feeding them needs too much” (FGD 4 with HIV infected mothers).</i>   | Male infants over breastfeed than females  | Increased breastfeeding demand among boys than girls      |
| <i>Those boys can feed, they want to breastfeed every second and I feared my breast may get torn. (FGD 1 with HIV infected mothers).</i>   |  |   |
| <i>They [meaning male HEIs] feed so much. We [meaning HIV infected postpartum mothers] don’t get peace at all, the girls feed a bit less and we can manage our daily activates while breast feeding (FGD 2 with HIV infected mothers).</i>   |  |   |
| <i>The boys, once they get teeth, they can bite so hard and it’s so painful</i>  |  |   |

|  |  |  |
|--|--|--|
| <i>and so I had to stop him from breast feeding (FGD 1 with HIV infected mothers).</i> |  |  |
|--|--|--|

HIV infected postpartum mothers reported that male HEIs breastfed more frequently than female HEIs. Accordingly, male HEIs were stopped from breastfeeding earlier than female HEIs as illustrated in the below excerpts.

*“Those boys can feed, they want to breastfeed every second and I feared my breast may get torn. Personally, I stopped breast feeding boys at 9 months because feeding them needs too much”* (FGD 1 with HIV infected mothers).

*“They [meaning male HEIs] feed so much. We [meaning HIV infected postpartum mothers] don’t get peace at all, the girls feed a bit less and we can manage our daily activities while breast feeding”* (FGD 2 with HIV infected mothers)

Healthcare providers reported that primiparous and secundiparous mothers had less interest in breastfeeding compared to multiparous mothers. In most cases, primiparous mothers were unwilling to breast. Also, some of the mothers had missed important information about breastfeeding guidelines.

*“The girls who have one or two children do not want to breast feed, they say that they do not want their breasts to fall”* (KII 1 with healthcare provider).

*“When mother is far, she comes late, some times when I have finished health education and she ends up missing. Somehow she may fail to follow the guideline and even breast feed more than one year or believe that not breast feeding when the teeth are out is the better”* (KII 3 with healthcare provider).

Casual and formal work demands had resulted into difficulties in striking a balance between breastfeeding and work among HIV infected postpartum mothers. Qualitative data indicated that postpartum mothers had ceased to breastfeed HEIs in order to earn a living.

*“How can I start to breastfeed on day 1 until 1 year? I have seen some other young girls leaving their children with the grand mothers and go work in other houses as house workers, they end up leaving the child from breast feeding at even 6months once they start eating, this is very common”* (FGD 3 with HIV infected mothers).

*“I am just 23 years with my child, I had to leave him at home with his grandmother and go to work to support him so he does not get consistence breast milk and ended up leaving to breast feed completely by himself. But he is okay after all he started to breastfeed early”* (FGD 3 with HIV infected mothers).

## Discussion

We studied cessation of breastfeeding at one year among infants born to HIV infected postpartum mothers in a large peri-urban health facility in Wakiso district, Uganda. Our data shows that 64% of HIV infected postpartum mothers cease breastfeeding at one year which is distant from the World Health Organization (WHO) and Uganda National EMTCT policy recommended target of 100% (7). This finding implies that most HEIs are breastfed for a longer duration than recommended and this places them at an increased risk of HIV acquisition. The health facility needs to develop context-specific interventions to improve cessation of breastfeeding at one year so as to achieve the goal of EMTCT of less than 5% HIV transmission among breastfeeding population (7). Past studies in Ethiopia reports cessation of breastfeeding at 34% (18) and 45.5% (19), which is relatively lower than what we report in this study. The observed differences could possibly be attributed to cultural differences in breastfeeding between the two countries. In Uganda, breastfeeding is a norm and is embraced by almost all cultures, except for medical or public health measures such as PMTCT.

Our study shows that cessation of breastfeeding at one year is more likely for female than male HEIs. This is a surprising finding as one would not expect any differences in breastfeeding duration with respect to sex. We did not find biologically plausible reasons to explain the association between sex and cessation of breastfeeding from published studies. However, qualitative results indicate that male HEIs breastfeed more often than female HEIs. Mothers mentioned that breastfeeding male HEIs has a draining and exhausting effect hence the early cessation of breastfeeding. Despite the differences, our finding seems to suggest that routine provision of health education on the benefits of infant breastfeeding until one year among HIV infected mothers remains important in EMTCT.

We found multiparous HIV infected postpartum mothers were more likely to cease breastfeeding at one year relative to primiparous mothers. This might have resulted from differences in experience with the EMTCT program, with multiparous mothers having sufficient knowledge and experience compared to nulliparous mothers. Our finding is consistent with that of Hackman *et al* (2015)(19) who observed that maternal parity determines the time at which breastfeeding is ceased. Hackman *et al* (2015)(19) found that multiparous HIV infected mothers had significantly longer breastfeeding duration than primiparous mothers. One of the reasons attributed to this finding is knowledge inadequacy among primiparous mothers about the importance of breastfeeding because majority were unwilling to breastfeed with the perception that it would result into voluminous breasts. A study in Ethiopia shows that mothers deficient in EMTCT knowledge are less likely to adhere to breastfeeding guidelines.(20) Our finding could also imply that experience with the EMTCT program is crucial factor for cessation of breastfeeding given the differences in between primiparous and multiparous mothers. In general, our result is an indication that primiparous HIV infected postpartum mothers might benefit from targeted health education messages compared to multiparous mothers.

Our study shows that breastfeeding initiation on same-day as birth is associated with reduced likelihood of cessation of breastfeeding at one year compared to breastfeeding initiation on another day. Failure to initiate breastfeeding on same-day as birth could be explained by several reasons namely, insufficiency of breast milk, low birth weight, and premature birth among others.(21) We hypothesized that mothers who

initiate breastfeeding on same-day as birth are those knowledgeable about the importance of breastfeeding in the first few hours of birth. Our finding implies that healthcare providers should emphasize the importance of early initiation of breastfeeding within the first hour of birth to all postpartum mothers regardless of HIV infection status. In the context of HIV, cessation of breastfeeding at one year should be strongly emphasized to prevent mother to child transmission of HIV. Further research is needed to understand barriers to uptake of Option B policy on cessation of breastfeeding at one year in this setting and similar areas.

## **Study Strengths And Limitations**

This study has several strengths. First, it is among the first study in Uganda to examine the implementation of the WHO policy recommendation on cessation of breastfeeding at one year among HIV infected mothers following its adoption in 2016. Second, the use of qualitative data to enrich and triangulate the quantitative findings is another strength. However, a number of limitations should be considered in the interpretation of the results. We used a retrospective cohort study design and this design by default does not demonstrate causation rather association. Our study was conducted in a peri-urban health facility so the results might not be generalizable to rural health facilities. We did not study several potential confounders such as healthcare workers EMTCT knowledge and attitude, role of mentor mothers, HIV stigma, maternal decision-making power, family support system, and antenatal attendance because we used secondary data and this was an important limiting factor. However, we tried to overcome this problem by incorporating qualitative data to enrich the quantitative data although peer mothers who held rich experience about breastfeeding were not interviewed. Although we encouraged equal participation during FGD, it is likely that the inclusion of mothers of all ages in the same group might have prevented younger mothers from fully expressing themselves. There is a possibility that data recorded in the registers might have recording and transcription errors although we attempted to verify the data for accuracy. Our study could not conclude on the outcomes of HEIs transferred to other health facilities because it was logistically impractical to obtain such data. Lastly, our sample size was relatively small despite the inclusion of all mother-baby pairs in the cohort.

## **Conclusions And Recommendations**

Our study shows that 64% of HIV infected postpartum mothers cease breastfeeding at one year, which is substantially lower than the WHO recommended target under the EMTCT policy. Healthcare systems should therefore strengthen the implementation and adoption of the EMTCT policy. We found cessation of breastfeeding at one year was more likely for female HEIs than male HEIs, among multiparous than primiparous HIV infected postpartum mothers, and less likely when breastfeeding was initiated on same-day as birth relative to another day. Qualitative data showed that partner reminders about breastfeeding, and adequacy of breastfeeding knowledge and maternal literacy promoted continued breastfeeding until one year. However, insufficient breastfeeding knowledge, casual and formal work demands, and increased breastfeeding demand among boys than girls fueled cessation of breastfeeding before one

year. We recommend the strengthening of health education messages on infant feeding in the context of HIV among every HIV infected postpartum mother and expectant women. Further robust studies are needed to underscore reasons for preferential breastfeeding of male HEIs relative to females.

## List Of Abbreviations

aRR: Adjusted Risk Ratio.

EID: Early infant diagnosis of HIV.

EMTCT: Elimination of mother to child transmission of HIV.

HEI: HIV exposed infant.

HIV: Human Immunodeficiency Virus.

uRR: Unadjusted Risk Ratio.

WHO: World Health Organization.

## Declarations

### Ethics and consent to participate

This study was approved by Clarke International University Research Ethics Committee, CIU-REC (reference # CIU-REC/0136) and received administrative approval from the Health Department of Wakiso district (reference # CR: MSMC 220/1). All participants interviewed provided written informed consent and were free to withdraw at any stage if they so wished.

### Consent for publication

Not applicable.

### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interest.

### Funding

None.



## Author contributions

JGP, JI and SO: Study conception and design. JGP: Acquisition of data. JI: Analysis and interpretation of data. JI and SO: Drafting of manuscript. JI and SO: Critical revision. All authors read and approved the final manuscript.

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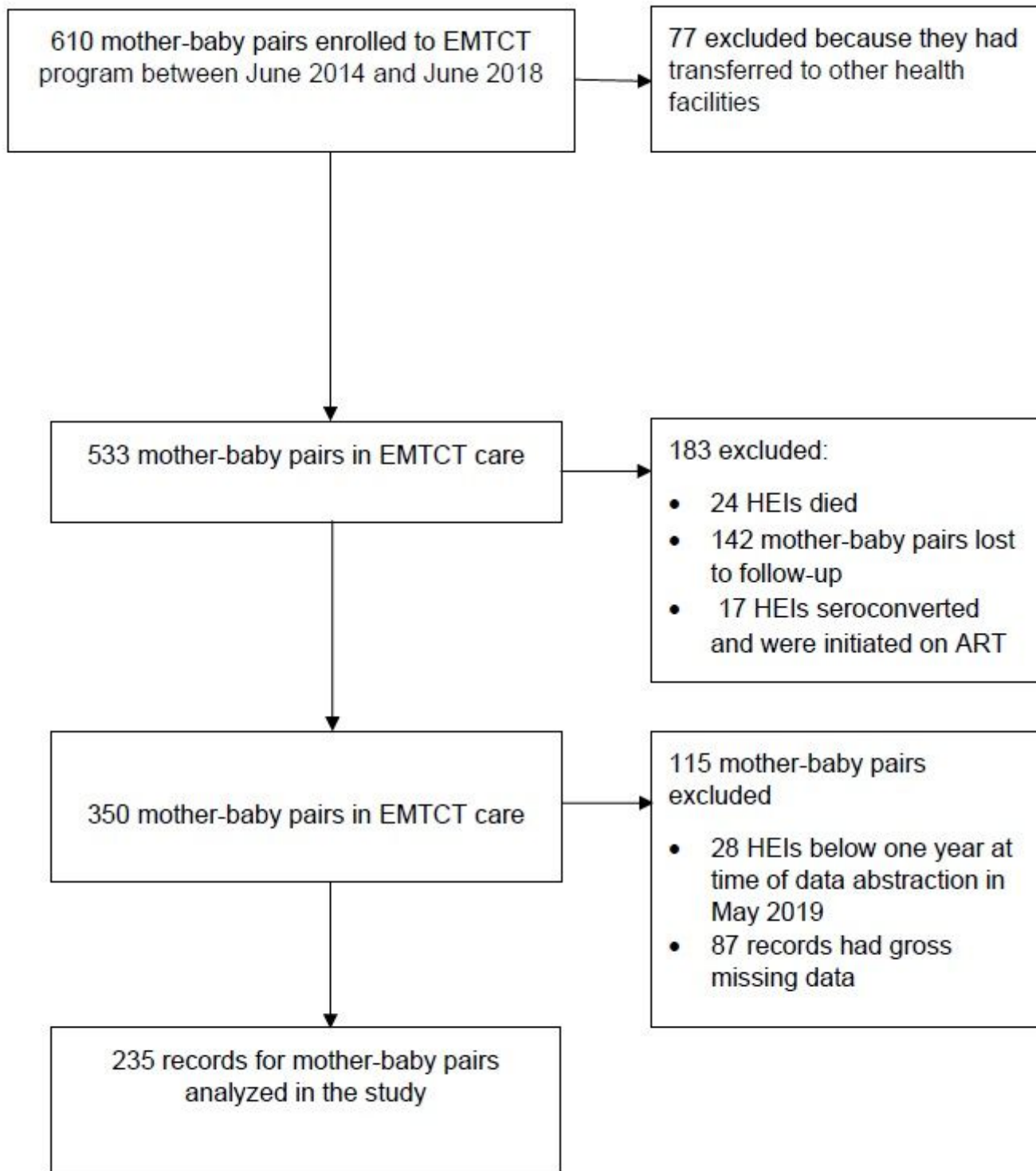
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## References

1. World Health Organization (WHO). Guideline: updates on HIV and infant feeding: duration of breastfeeding, and support from health services to improve feeding practices among mothers living with HIV. WHO Publications. 2016:1–59.
2. UNAIDS. Country factsheets Uganda 2018: UNAIDS; 2018 [cited 2020 March 10]. Available from: <https://www.unaids.org/en/regionscountries/countries/uganda>.
3. Kuhn L, Kasonde P, Sinkala M, Kankasa C, Semrau K, Vwalika C, et al. Prolonged breast-feeding and mortality up to two years post-partum among HIV-positive women in Zambia. *AIDS* (London, England). 2005;19(15):1677.
4. Duber HC, Dansereau E, Masters SH, Achan J, Burstein R, DeCenso B, et al. Uptake of WHO recommendations for first-line antiretroviral therapy in Kenya, Uganda, and Zambia. *PloS one*. 2015;10(3).
5. Ladner J, Besson M-H, Rodrigues M, Saba J, Audureau E. Performance of HIV prevention of mother-to-child transmission programs in sub-Saharan Africa: longitudinal assessment of 64 Nevirapine-based programs implemented in 25 countries, 2000-2011. *PloS one*. 2015;10(6).
6. Al-Mujtaba M, Sam-Agudu AN, Rose Khatri R. Barriers to the practice of exclusive breastfeeding among HIV-positive mothers in sub-Saharan Africa: A scoping review of counselling, socioeconomic and cultural factors; *Journal of AIDS and HIV research*. *Journal of AIDS and HIV Research*. 2016;8(6):70-9.
7. AVERT. Prevention of mother to child transmission (PMTCT) of HIV Global Information and education on HIV and AIDS; 2019 [updated March 8, 2019; cited 2020 March 10]. Available from: <https://www.avert.org/professionals/hiv-programming/prevention/prevention-mother-child>.
8. Republic of Uganda. Health Sector Strategic Plan III 2010/11-2014/15. Kampala, Uganda: Ministry of Health, 2010.
9. Republic of Uganda. Consolidated guidelines for prevention and treatment of HIV in Uganda. Kampala: Ministry of Health, December 2016.
10. Izudi J, Akot A, Kisitu GP, Amuge P, Kekitiinwa A. Quality Improvement Interventions for Early HIV Infant Diagnosis in Northeastern Uganda. *BioMed Research International*. 2016;2016:8.

11. Izudi J, Auma S, Alege JB. Early Diagnosis of HIV among Infants Born to HIV-Positive Mothers on Option-B Plus in Kampala, Uganda. *AIDS Research and Treatment*. 2017;2017:8.
12. AIDS Treatment and Information Center, Infectious Diseases Institute, Makerere University. AIDS Treatment Information Center newsletter. Quarterly newsletter of the AIDS Treatment Information Center, Infectious Diseases Institute, Makerere University. March 2014:1, 3, 5.
13. Mason M, editor Sample size and saturation in PhD studies using qualitative interviews. *Forum qualitative Sozialforschung/Forum: qualitative social research*; 2010.
14. Lauritsen J, Bruus M. EpiData (version 3). A comprehensive tool for validated entry and documentation of data Odense: EpiData Association. 2003.
15. Stata Statistical Software: Release 15 [press release]. College Station, TX: StataCorp LLC2017.
16. Schmidt OC, Kohlmann T. When to use the odds ratio or the relative risk? *Int J Public Health*. 2008;53:165-7.
17. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. *Am J Epidemiol*. 2005;162(3):199-200.
18. Haile D, Belachew T, Birhanu G, Setegn T, Biadgilign S. Predictors of breastfeeding cessation among HIV infected mothers in southern Ethiopia: a survival analysis. *PloS one*. 2014;9(3).
19. Hackman NM, Schaefer EW, Beiler JS, Rose CM, Paul IM. Breastfeeding outcome comparison by parity. *Breastfeeding Medicine*. 2015;10(3):156-62.
20. Alemu YM, Habtewold TD, Alemu SM. Mother's knowledge on prevention of mother-to-child transmission of HIV, Ethiopia: A cross sectional study. *PloS one*. 2018;13(9).
21. Ogwu A, Moyo S, Powis K, Asmelash A, Lockman S, Moffat C, et al. Predictors of early breastfeeding cessation among HIV-infected women in Botswana. *Tropical Medicine & International Health*. 2016;21(8):1013-8.

## Figures



**Figure 1**

Study profile

## Supplementary Files

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